U. S. DEPARTMENT OF AGRICULTURE - FOREST SERVICE
CALIFORNIA FOREST AND RANGE EXPERIMENT STATION
Division of Forest Insect Research

ANNUAL REPORT OF FOREST INSECT CONTROL ARROWHEAD-CRESTLINE INFESTATION AREA SAN BERNARDINO NATIONAL FOREST FISCAL YEAR 1953

INTRODUCTION

The Arrowhead-Crestline infestation area is located within the San Bernardino National Forest in southern California. This forest, in common with others in the southern part of the State, receives high use for recreational purposes. Numerous summer homes, year long residences, resorts, organizational camps, winter sports areas, and picnic and campground sites are to be found within its boundaries. In this capacity, it accommodates approximately 2,850,000 persons annually.

Forest insect control in the Arrowhead-Crestline infestation zone is not new to this area. Efforts to control forest insect damage were inaugurated during the winter of 1921-22, when the Arrowhead Lake Company treated some 64 trees on their own and adjacent holdings. Since that first project a somewhat erratic course seems to have been followed in controlling forest insect damage. Attempts were made to suppress outbreaks during years of heavy tree mortality, but during the intervening periods no program was carried out to hold the ground that had been gained. In the winter of 1939-40, a large scale project was conducted which was a cooperative undertaking involving the State of California, the San Bernardino County Flood Control District and the United States Government. Since that time control projects have been conducted annually on the same cooperative basis. Unfortunately, they have been in the nature of a minimum effort, and have not provided adequately for a complete appraisal, spotting and treating of insect infested trees over the entire area except during years of endemic loss.

Since 1947, there has occurred a gradual buildup of insect populations which culminated in the cooperative project of this past season. Although there have been annual control projects each year during this buildup, the program prior to the present one has not been entirely adequate to meet needs. 1/

THE INFESTATION

Boundaries

In the past the boundaries of the winter control projects have been confined to the immediate area surrounding the populated centers. This served to protect the high use areas from serious damage during years when bark beetle population were endemic. With the general buildup of bark beetle populations since 1947,.

1/ For further information see "A review of insect control in the Arrowhead-Crestline infestation area, 1921-1953" by A. D. Moore, Forest Insect Laboratory, Berkeley, California, February 27, 1953.

there has occurred a growing need for extending these boundaries farther and farther from the high use areas, in order to prevent reinfestation from untreated areas. This need has been partially met, but because of financial limitations it has not been adequate to cope with the problem. Recognizing that the bark beetle populations to be encountered in the 1952-53 control project would be larger and more widespread than previously, it was decided to expand the boundaries of the control zone to encompass a currently entomologically sound working unit. The new boundaries included all timbered areas between the brushline on the north and the brushline on the south, and from Sawpit Canyon on the west to Deep Creek on the east. (See attached map) Thus, the possibility of reinfestation of high use areas was all but eliminated, providing the control project was successful against the insect populations within the new boundaries.

Timber Type

The major portion of the area is pure ponderosa pine in the young to mature age groups with some mixture of white fir and incense cedar and a small amount of Jeffrey pine. Coulter pine takes in a sizeable area along the brushline on the north side of the infestation zone.

Host Species and Insect

Host and major insect species are as follows:

Coulter pine - the western pine beetle, Dendroctonus brevicomis Lec., the California flatheaded borer, Melanophila californica Van Dyke, and the pine engraver beetle, Ips sp.

Ponderosa pine - the western pine beetle, Dendroctonus brevicomis Lec., the mountain pine beetle, Dendroctonus monticolae Hopk., the California flatheaded borer, Melanophila californica Van Dyke, the pine engraver beetles, Ips sp., and the black pine leaf scale, Nuculaspis californica (Coleman).

Jeffrey pine - the Jeffrey pine beetle, Dendroctonus jeffreyi Hopk., the California flatheaded borer, Melanophila californica Van Dyke, and the pine engraver beetle, Ips, sp.

Sugar pine - the mountain pine beetle, Dendroctonus monticolae Hopk., the pine engraver beetle, Ips sp., and the black pine leaf scale, Nuculaspis californica (Coleman).

White fir - the fir engraver beetle, Scolytus ventralis Lec.

Although the 1952-53 control project was directed against the western pine beetle, and to a limited extent against the mountain pine beetle, these are not the only insect species responsible for tree mortality in this area. Within recent years, the Jeffrey pine beetle has shown a decided increase in its populations, and as a result, it has become necessary to treat many Jeffrey pines infested with this beetle. Inasmuch as the Jeffrey pine beetle did not pose the

immediate threat that the western pine beetle did, it was decided to forego treating Jeffrey pines for the 1952-53 season and concentrate all efforts on the western pine beetle problem. However, it will be necessary to treat Jeffrey pine beetle infested trees in the future as this insect species is capable of causing heavy tree mortality when left uncontrolled.

White fir damage, due to insects, has been extremely high for the past three to four years, but now shows signs of returning to an endemic level. No control measures have been recommended against the insect responsible for this tree mortality, primarily because no satisfactory methods of control have ever been worked out. Over the years there have been brief periods when severe white fir losses have occurred throughout the state. These losses, although alarming, have not received a great deal of attention because most of the loss has occurred where the species has little economic value. White fir in many recreational areas, however, is a primary tree species and, therefore, every effort should be made to develop methods of preventing or controlling insect damage.

Incense cedar is relatively free of insect enemies, and has not suffered any noticeable insect caused mortality recently.

Sugar pine loss has been light to moderate this past year, and insect infested sugar pines have been included in the control operation.

In addition to the bark beetle activity mentioned, there occurs generally on all pine species throughout the area the black pine leaf scale. This scale is most prevalent on ponderosa pine where it causes discolored, shortened needles, and sparse needle complements. Scale infested trees, which are shabby and unsightly, are most common in the Crestline-Lake Gregory area. Research is needed to determine the extent to which scales predispose the trees to bark beetle attack, and also their ability, if any, to cause outright tree mortality. Much remains to be known about the reasons for large buildups of this scale and possible preventive and control measures.

PLANNING AND PREPARATION FOR CONTROL

The initial step in planning for the 1952-53 control project was the preparation of a cooperative agreement dated September 15, 1952, between the U.S. Forest Service, the California State Division of Forestry and the San Bernardino County Flood Control District. Under this agreement, the Forest Service agreed to pay the cost of insect control on federal lands, up to $5350.00, and to undertake the control project on both federal and private lands. The State, under authority of the San Bernardino Zone of Infestation, declared by the State Board of Forestry on February 16, 1946, agreed to pay half the cost of control on private lands, up to $5350.00. Thus a total of $16,050.00 was available at the outset of the project.

On October 7, 1952, estimates made by San Bernardino National Forest showed that some 2,000 trees would require treatment at a cost of about $35,000. Since thes estimates indicated a project much larger than had been anticipated, a reappraisal of the infestation was made by the Forest Insect Laboratory in December 1952. 2/

2/ "Forest Insect Survey, San Bernardino National Forest, December 1952, Appraisal Survey" by R. E. Stevens, Forest Insect Laboratory, Berkeley, California, January 19, 1953.

On the basis of ground and aerial examinations, this survey disclosed that the estimated number of trees needing treatment was 1600, with a probable error of 25 per cent. The Laboratory recommended that an all-out effort to control the infestation be undertaken. The cost was estimated to be $32,000.

On January 7, 1953, representatives of the land managing agencies involved visited the project area and discussed the situation on the ground.

On February 12, 1953, following this review, the original agreement of September 15, 1952, was amended to provide for an expanded control program. This new agreement provided that the State pay half the cost of treatment on private land, up to $10,700.00; the San Bernardino Flood Control District paying one-quarter of the cost on private land, up to $5,350.00; and the Federal government, through emergency pest control funds, pay one-quarter of the cost of control on private lands, up to $5,350.00. In addition, funds for treatment of trees on federal lands were increased to $10,700.00. The Forest Service remained responsible for carrying out the control project on both federal and private lands under the terms of the revised agreement. As it turned out, the money provided for control on private lands proved adequate for the job. However, it soon became evident that more infested trees were being found on government land than on private in proportion to the relative acreages involved. Therefore, the Forest Service made available an additional $10,395.00 to cover the added cost of control being incurred on federal lands. This brought the final total available for control to $21,095.00 on federal lands and $21,400.00 on private lands. Of this, the actual money expended was $18,676.97 on federal lands and $19,580.34 on private lands.

THE CONTROL OPERATION

Crew Organization

All phases of the control operation were handled by personnel from the U. S. Forest Service.

Although a few trees were treated by fire crews during the summer months on a contributed time basis, it was not until November 23, 1952, that spotting and treating on a large scale were initiated. At that time 14 men were assigned to the project.

On February 16, 1953, the project was increased to include some 26 men, including six Zuni Indians who were transported from their reservation in New Mexico especially for this project. The project was manned at full strength until April 18th, at which time it was reduced to five men. It became apparent in early June that the effort being devoted to the project was not adequate to treat all infested trees remaining before the beetles emerged; hence the operation was again increased to include some thirteen men. These men remained with the project until the end of June, when there remained but few trees which had not been treated.

Due to the varying number of men connected with the project, the size of the spotting and treating crew fluctuated considerably. Ordinarily the treating crews were organized into three-man units. Spotting crews varied in size

according to the area to be spotted. Where cabins and small tracts were involved one or two men were able to work efficiently, but on larger areas usually three or four men worked together. In the latter case, a new system was employed on this project: that of using string lines. The man spotting on the outside strip in a crew laid down a string line which was used as a control line to work agains on the return strip. This system gave excellent results.

Technical assistance was furnished by the Forest Insect Laboratory, Berkeley, California.

Methods of Treatment

Basically two methods were used in destroying the insect broods in the trees: (1) burning the infested portions of the trees and (2) spraying the infested portions of the trees with a penetrating oil spray.

The burning method has been in standard use for many years. It consists merely of falling, limbing and barking of the trees. The limbs and bark are then piled alongside of the main bole of the tree and the entire pile set on fire and allowed to burn thoroughly. In smaller trees a variation of this method is to fall, buck into short lengths, pile and burn the entire tree.

Spraying infested trees is a more recent method. In this method, the trees are felled, bucked into suitable lengths for rolling, and then sprayed on all sides with a penetrating oil. It was found that best results could be obtained by using power spray units with a shower head type nozzle operating at 25 to 30 pounds pressure. This arrangement allows for a fair volume of spray at low pressure. When properly applied it results in no appreciable run-off, bounce off or loss of spray through misting action. To secure satisfactory results, it is necessary to roll the log during the course of treatment at least three to four times.

Transportation and Equipment

This being primarily a winter project, it was necessary to have available a variety of equipment. The following pieces of equipment were in use during the operation:

1 gravity feed tank, 500 gal.
1 power wagon w/60 gal. Bean spray unit
1 power wagon w/50 gal. Dobbins spray unit
2 four-wheel drive pickups w/60 gal. Dobbins spray unit
1 four-wheel drive pickup
1 jeep
1 station wagon
2 two-wheel drive pickups
1 sedan

In addition, climbing equipment, axes, wedges and miscellaneous smaller items were required.

In many cases it was necessary to fall trees in sections due to the proximity of houses, power lines and various other structures.

Insecticide Used

Many of the trees were treated with a penetrating oil spray consisting of technical orthodichlorobenzene (1 part) and diesel fuel (6 parts). The "ortho" was purchased from the Braun Corporation in Los Angeles in fifty-gallon drums. The diesel fuel was purchased locally. The spray was mixed in a 500-gallon tank at the ranger station and the various spray units were filled from this source as needed.

Another penetrating oil spray, ethylene dibromide and diesel fuel, shows promise of becoming a standard treatment on projects of this type. This spray is somewhat lower in cost than "ortho" and has been used with success on other similar projects.

Releases

On private land the spotters, in recording the infested trees, must determine which lot the tree or trees fall on so that the owner's name and address can be secured. Once this information is available a release form is sent to the land owner requesting his signature. This release allows the Forest Service to cut and treat all insect infested trees on the owner's property, and also absolves the Forest Service of any responsibility in case of damage while performing this task. Through persistence, and the generous cooperation of some local people, these releases were obtained in all but one or two cases. Several hundred releases were secured in this manner.

Control Statistics

	U. S.	Private	Total
Acreage	10,900	15,840	26,740
Trees spotted	1,003	1,051	2,054*
Trees treated (ortho)	472**	547	1,067
(peel and burn)	207	217	424
Sold to McKeen Lumber Co.	45	-	-
	724	764	1,488
Average d.b.h.	21.5	18"	-
Man days	1,086	991	2,077
Trees treated per man day	1.5	.77	-
Approx. gals. of ortho used	-	-	1,822
Approx. gals. of diesel fuel used	-	-	11,046
Average number of gals. of spray per tree	-	-	12.06

*The difference in the total trees spotted and the total trees treated is accounted for by the fact that many of the spotted trees were abandoned by the insects before treating took place. Also, many of the trees were found to have pitched out or repelled the insect attack, and these trees were not felled and treated.

**This figure includes 85 trees which were sold to the Dexter Lumber Co. They were chemically treated to prevent emergence of the beetles at the mill.

RESULTS

Mortality Sampling

To determine the overall effectiveness of the penetrating oil spray method of treating insect-infested trees on this control project, several treated log samples, plus similar log samples that had not been treated, were caged and the emergence of western pine beetle adults recorded. All samples were selected at random from the mid-bole of the infested trees. These samples were suspended in mid-air beneath racks and enclosed in large cloth feed sacks to which a jar was attached beneath, the principle being that the emerging beetles would be unable to escape the confines of the cloth sacks and would end up in the jars attached to these sacks. The jars contained water plus salt to prevent freezing. This was necessary to prevent predators from dismembering the bark beetles before they could be counted. Due to the rush of other activities occurring at this same period, it was not possible to keep a close watch over the rearing samples during the entire course of the undertaking. As a result, counting of the emerging adult bark beetles was rather infrequent. Also, in several cases it was necessai to discard samples because of broken jars, fallen samples, ripped sacks and etc. Only the samples for which a complete record was available were used in the final analysis. Following is a summary of the results obtained:

	Treated	Check
Number of samples	23	7
Total number of beetles emerged	383	1128
Average number of beetles emerged per sample	16.65	161.14
Total number of sq. ft. of bark surface	116.54	35.33
Average number of sq. ft. of bark surface/ sample	5.07	5.05
Average number of w.p.b. emerged/sq. ft. of bark surface	3.08	31.91

This is a reduction of emergence from treated samples over non-treated samples of 89.72%.

It must be remembered that because the samples were taken at random in the field they reflect not only the limitations of the penetrating oil spray used but the element of human error in applying this spray as well. The distribution of emergence throughout the treated samples would seem to indicate that this latter element is, indeed, a limiting factor in achieving a 100 per cent mortality goal

Costs

	Available	Expended
Federal Lands		
U.S. Forest Service	$21,095.00	$18,676.97
Private Lands		
U.S. Pest Control	5,350.00	
State of California	10,700.00	} carry-over funds
San Bernardino Flood Control District		
Zone 5	5,000.00	
Zone 3	350.00	not available
Private Total	$21,400.00	$19,580.34
Federal and Private Total	$42,495.00	$38,257.31

Balance not spent: Private $1,819.66

Federal 2,418.03

TOTAL $4,237.69

Cost per tree

U. S. $25.79

Private $25.63

A percentage breakdown on the major expense items is as follows:

Total salary	63
Equipment rental and operation	12
Ortho and diesel fuel	11
Purchase chain saw equipment	4
Miscellaneous supplies and equipment	6
10% overhead charge on private land	4
	100%

RECOMMENDATIONS:

1. That a program of year-round maintenance control be adopted to replace the old system of winter control. This is in progress for 1953-54.

2. That contracting out of at least part of the control operation be tried on a small scale.

3. That research studies into the possibilities of thinning pole-size stands to reduce insect-caused losses be initiated when, and if, manpower and funds are made available.

4. That all Jeffrey pine beetle infested trees, within the zone of infestation, be treated during the 1953-54 control year.

5. That a study be undertaken to determine the severity of the black pine leaf scale infestation and its interrelationship with bark beetle losses.

Berkeley, California
April 6, 1954

G. L. Downing
Entomologist